

# FRBSF WEEKLY LETTER

Number 92-35, October 9, 1992

## The Dollar: Short-Run Volatility and Long-Run Adjustment

The foreign exchange value of the dollar is relatively volatile because, like other financial assets, its value in the short run is determined by forward-looking expectations. Ultimately, these expectations should tend to be consistent with fundamental economic factors. But economists have had difficulty in identifying the relative importance of these fundamentals, especially for the dollar. Indeed, a widely held view is that existing economic models of the dollar cannot predict its movements any better than can a naive model that simply assumes no change.

This *Weekly Letter* reports on some new research on this issue (Throop, 1992). This research shows that the adjustment of the dollar's value to fundamental economic factors is an important part of its short-run movements. Moreover, a model that takes this adjustment into account predicts the dollar's value significantly better than does a model of no change.

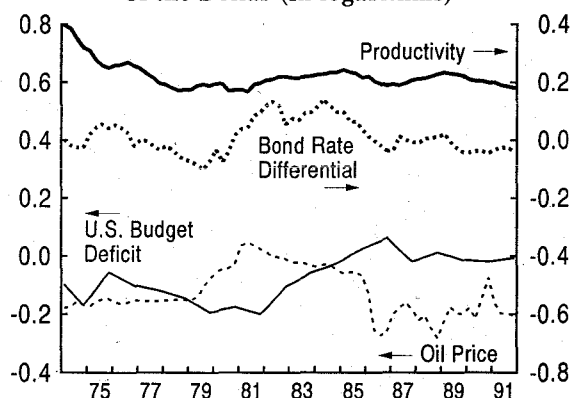
### Long-run fundamentals

The model of the dollar focuses on its real trade-weighted value, which incorporates values of the major currencies with which we trade. The real trade-weighted value of the dollar is obtained by multiplying its nominal trade-weighted value in terms of foreign currencies times the ratio of the U.S. price level to the foreign trade-weighted price level. The higher the real value of the dollar, the greater its relative purchasing power of foreign goods and services. Four factors—productivity, oil prices, budget deficits, and long-term interest rates—primarily affect the real value of the dollar (see Chart 1). Each is discussed in turn.

1. *Productivity.* Other things being equal, the exchange rate tends to adjust so as to equalize prices of traded goods at home and abroad in the same currency. This tends to keep the real exchange rate constant *when measured in terms of the prices of the traded goods*. But the real trade-weighted dollar is measured in terms of *overall price levels*—that is, it includes the prices of non-traded goods as well. So if productivity in traded goods relative to all goods were to grow

more slowly in the U.S. than abroad, the real value of the dollar *measured in terms of overall price levels* would decline.

Chart 1  
Contributions of Fundamental  
Economic Factors to Real Value  
of the Dollar (in logarithms)



Prices of traded goods can be proxied by wholesale prices, while the overall price level is approximated by consumer prices. In the 1970s, productivity growth in U.S. traded goods relative to all goods tended to lag that abroad. As shown in Chart 1, in the latter half of the 1970s this factor is estimated to have contributed to a significant depreciation in the real trade-weighted value of the U.S. dollar. But in the 1980s this factor accounted for relatively little change in the dollar's value.

2. *Real Price of Oil.* Economies differ with respect to their dependence on imported oil. Although the U.S. imports about 40 percent of its oil requirements, it is less dependent on foreign oil than most of its major trading partners. As a result, when the real price of oil rises, the real value of the U.S. dollar tends to appreciate.

As shown in Chart 1, the sharp rise in the real price of oil in the late 1970s and early 1980s is estimated to have contributed significantly to

# FRBSF

increasing the real value of the U.S. dollar. In contrast, in 1986 a similar sharp decline in the real price of oil reduced U.S. competitiveness, thus contributing to a sharp decline in the dollar's value.

**3. U.S. Budget Deficit.** A larger U.S. budget deficit tends to put upward pressure on U.S. (and ultimately foreign) interest rates and to draw capital in from abroad. Stronger foreign capital inflows, in turn, work to appreciate the dollar. These capital inflows, and hence a stronger dollar, will persist even after U.S. and foreign interest rates have equalized at a higher level. Although interest will have to be paid to foreigners on the increased indebtedness, which decreases the net demand for dollars to some extent, the overall effect of budget deficits is still to appreciate the dollar. In short, budget deficits affect the value of the dollar independently from their effects on interest rates.

Chart 1 shows that rising U.S. budget deficits are estimated to have contributed significantly to the appreciation of the real value of the dollar in the early 1980s. The U.S. government's larger demands for capital generated persistently higher foreign capital inflows, which tended to keep the dollar relatively strong.

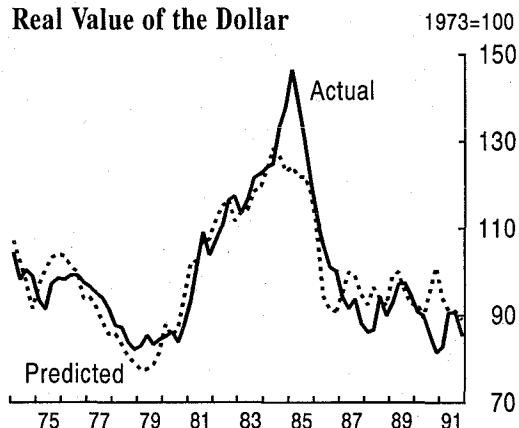
**4. Real Long-Term Interest Rates.** A final fundamental economic factor is the open interest parity relationship; that is, the dollar's value will adjust until the total expected return on assets denominated in dollars just equals the total expected return on assets denominated in foreign currency, plus or minus a risk premium. The expected returns include not only pure interest returns, but also the expected capital gains or losses arising from anticipated changes in currency values. The higher are real interest rates in the U.S. relative to real interest rates abroad, the higher should be the real value of the dollar—with an expected depreciation to a long-run equilibrium value determined by the other three fundamental economic factors offsetting the higher interest returns in the U.S.

Chart 1 shows that a falling differential between U.S. and foreign real long-term interest rates contributed significantly to a falling value of the dollar in the late 1970s. The differential then rose sharply in the first half of the 1980s and fell almost equally sharply in the second half, contributing correspondingly to strength and then weakness in the dollar.

## Short-run adjustment

Chart 2 shows the total estimated contributions of all four fundamental economic factors to movements in the real trade-weighted value of the dollar in the period of floating exchange rates. These four factors explain about 80 percent of the (in-sample) variation in the real value of the dollar in this period. Why do these four factors tend to explain the major swings in the dollar's value but miss some of the minor ones? The reason is that it takes times for the market to perceive the long-run effects of the fundamental economic factors; in other words, expectations about the equilibrium value of the dollar—and hence the dollar's current value—adjust only gradually to changes in these fundamentals.

**Chart 2**  
**Real Value of the Dollar**

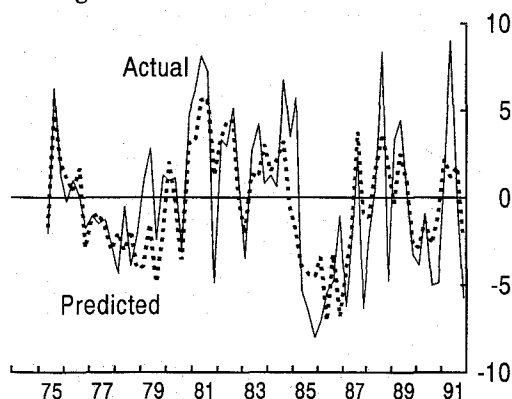


This adjustment may best be captured by an error correction model, in which a portion of the difference between the dollar's actual value and its equilibrium value determined by the fundamentals is eliminated each quarter. First, through short-run open interest parity, the change in the real value of the dollar between the current quarter and the value expected for the next quarter depends upon the real three-month interest rate differential. Second, the value expected for the next quarter is revised according to an error correction process, so that it gradually approaches the equilibrium value determined by the four fundamental economic factors.

Chart 3 shows the *in-sample* predictions of quarterly changes in the real trade-weighted value of the dollar according to this model, which explain about one half of their variation. According to the estimated model, about 25 percent of the gap between the equilibrium real value of the dollar

determined by economic fundamentals and its actual value tends to be eliminated per quarter. In addition, small "bandwagon effects" are present, with a 1 percent change in the dollar in the previous quarter generating a  $\frac{1}{4}$  percent further change in the same direction in the current quarter.

**Chart 3**  
**Change in Real Value of the Dollar** Percent



*Out-of-sample* predictions are an important test of a model because they use data other than that on which the model was estimated. In contrast to most economic models of the dollar, *out-of-sample* predictions of *changes* in the dollar with this model (using actual values of the explanatory variables) have substantially lower errors than those obtained from a naive model of no change. The model was first estimated for the period 1974.Q1 through 1981.Q4. Then predictions for one, four, and eight quarters ahead of *changes* in the dollar were made using the actual values of the explanatory variables. The estimation was then updated to include successively more quarters, allowing additional *out-of-sample* predic-

tions to be made. The root mean squared error of one-quarter-ahead predictions is 15 percent lower than those obtained from the naive model. For four and eight quarters ahead, the error is 33 and 60 percent lower, respectively.

### Conclusions

This model of the dollar has some important implications for monetary policy. Previous research has emphasized the role of real interest rate differentials between the U.S. and abroad in determining the real value of the dollar. However, skeptics have pointed to the inability of such models to hold up outside of the sample period in which they were estimated. This model of the dollar shows that real factors in addition to interest rates—namely productivity, the real price of oil, and budget deficits—also play a significant role. Moreover, this model holds up out of sample. But taking these additional factors into account reduces the estimated effects of interest rates on the dollar. As a result, I conclude that the influence of monetary policy on the international sector of the economy, operating via interest rates, probably is lower than previously thought.

**Adrian W. Throop**  
**Research Officer**

### References

- Meese, Richard. 1990. "Currency Fluctuations in the Post-Bretton Woods Era." *Journal of Economic Perspectives* (Winter).
- Throop, Adrian W. 1992. "A Generalized Uncovered Interest Parity Model of Real Exchange Rates." Federal Reserve Bank of San Francisco, Working Papers in Applied Economic Theory, No. 92-04.

P.O. Box 7702  
San Francisco, CA 94120

**San Francisco**  
**Bank of**  
**Federal Reserve**  
**Research Department**

**Index to Recent Issues of *FRBSF Weekly Letter***

DATE	NUMBER	TITLE	AUTHOR
3/20	92-12	Foreign Direct Investment: Gift Horse or Trojan Horse?	Kim
3/27	92-13	U.S. International Trade and Competitiveness	Glick
4/3	92-14	Utah Bucks the Recession	Cromwell
4/10	92-15	Monetary Announcements: The Bank of Japan and the Fed	Hutchison/Judd
4/17	92-16	Causes and Effects of Consumer Sentiment	Throop
4/24	92-17	California Banks' Problems Continue	Zimmerman
5/1	92-18	Is a Bad Bank Always Bad?	Neuberger
5/8	92-19	An Unprecedented Slowdown?	Trehan
5/15	92-20	Agricultural Production's Share of the Western Economy	Schmidt/Dean
5/22	92-21	Can Paradise Be Affordable?	Cromwell/Schmidt
5/29	92-22	The Silicon Valley Economy	Sherwood-Call
6/5	92-23	EMU and the ECB	Walsh
6/19	92-24	Perspective on California	Sherwood-Call
7/3	92-25	Commercial Aerospace: Risks and Prospects	Cromwell
7/17	92-26	Low Inflation and Central Bank Independence	Parry
7/24	92-27	First Quarter Results: Good News, Bad News	Trenholme/Neuberger
8/7	92-28	Are Big U.S. Banks Big Enough?	Furlong
8/14	92-29	What's Happening to Southern California?	Sherwood-Call
9/4	92-30	Money, Credit, and M2	Judd/Trehan
9/11	92-31	Pegging, Floating, and Price Stability: Lessons from Taiwan	Moreno
9/18	92-32	Budget Rules and Monetary Union in Europe	Glick/Hutchison
9/25	92-33	The Slow Recovery	Throop
10/2	92-34	Ejido Reform and the NAFTA	Schmidt/Gruben

The *FRBSF Weekly Letter* appears on an abbreviated schedule in June, July, August, and December.